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Attorney Docket No. 1087.1013

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of:

Bennett et al.

Application No.: To be assigned

Group Art Unit: To be assigned

Filed: May 25, 2001

Examiner: To be assigned

For: ARTICLE HANDLING SYSTEM

SUBMISSION OF CERTIFIED COPY OF PRIOR FOREIGN APPLICATION IN ACCORDANCE WITH THE REQUIREMENTS OF 37 C.F.R. §1.55

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Sir:

In accordance with the provisions of 37 C.F.R. §1.55, the applicant(s) submit(s) herewith a certified copy of the following foreign application:

British Patent Application No. 0012994.0

Filed: May 26, 2000

It is respectfully requested that the applicant(s) be given the benefit of the foreign filing date(s) as evidenced by the certified papers attached hereto, in accordance with the requirements of 35 U.S.C. §119.

Respectfully submitted,

STAAS & HALSEY LLP

Date: May 25, 2001

By: _____
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NP10 8QQ

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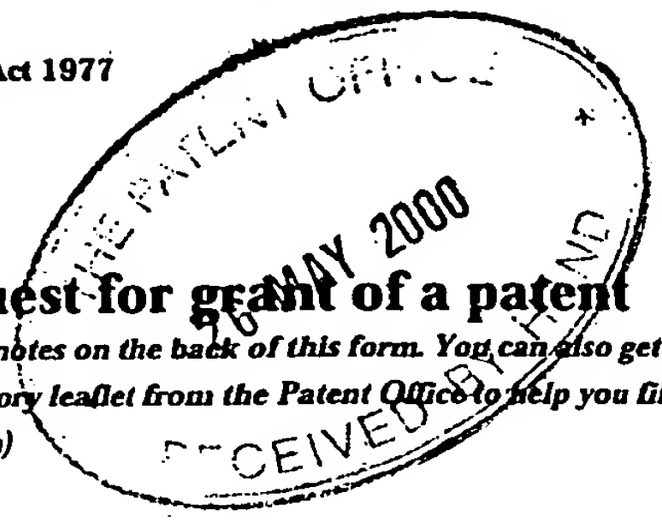

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1/77

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Cardiff Road
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1. Your reference — RSJ06643GB

2. Patent application number *(The Patent Office will fill in this part)* — 26 MAY 2000 — 0012994.0

3. Full name, address and postcode of the or of each applicant *(underline all surnames)*

ISHIDA CO., LTD
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JAPAN

Patents ADP number *(if you know it)*

If the applicant is a corporate body, give the country/state of its incorporation — JAPAN

07354913001

4. Title of the invention — ARTICLE HANDLING SYSTEM

5. Name of your agent *(if you have one)* — Gill Jennings & Every

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Broadgate House
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Patents ADP number *(if you know it)* — 745002

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Country	Priority application number *(if you know it)*	Date of filing *(day / month / year)*

7. If this application is divided or otherwise derived from an earlier UK application, give the number and the filing date of the earlier application

Number of earlier application	Date of filing *(day / month / year)*

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a) any applicant named in part 3 is not an inventor, or
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Claim *(s)*	3
Abstract	
Drawing *(s)*	5 4 5

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Priority documents	
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Statement of inventorship and right to grant of a patent *(Patents Form 7/77)*	
Request for preliminary examination and search *(Patents Form 9/77)*	1
Request for substantive examination *(Patents Form 10/77)*	
Any other documents *(please specify)*	NO

11. For the applicant
Gill Jennings & Every

I/We request the grant of a patent on the basis of this application.

Signature [signature] Date 26 May 2000

12. Name and daytime telephone number of person to contact in the United Kingdom

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ARTICLE HANDLING SYSTEM

The invention relates to an article handling system comprising a flow path along which articles travel in use; and a metal detection system for detecting the passage of metal items along the flow path. The invention also relates to a method of monitoring the performance of a metal detection system.

Metal detection systems are used in a large range of article handling systems, particularly those for handling food stuffs, to monitor for the presence of metal items. If a metal item is detected, the system must be stopped to enable the item to extracted.

It is important in these applications to check the sensitivity and performance of the metal detection system. In conventional weighing systems and the like in which articles such as potato chips are dropped generally vertically from a weighing machine to a packaging machine, the sensitivity of the metal detection system provided around the flow path is checked by dropping a metal test piece along the flow path. Conventionally, this has been done by manually dropping the test piece which may for example be an iron or stainless steel sphere and determining whether or not the metal detection system senses the passage of the item. This is then repeated with spheres of different sizes. In view of the need to introduce the metal item into the flow path, it is conventional to stop the article handling system while the sensitivity check is carried out.

There are a number of problems with the conventional systems. One of the most important is the need to recover the test piece after the test. This is often difficult to achieve and will result in significant waste of bags and the like while the test piece is located. It is therefore important to monitor the output from packaging machine to ensure that the metal piece can be retrieved.

In addition, particularly in the case of combination weighing machines, since the metal test piece is dropped through a relatively narrow opening, there is a risk that the test piece may be caught in a part of the machine and this will take significant time to recover. It is also important that the test piece passes a predetermined position to ensure that the sensitivity of the metal detection system is correctly adjusted. This is difficult to achieve with the conventional systems.

US-A-4726434 describes a method of checking the sensitivity of a metal detection system provided around a discharge chute of a combination weighing machine. In this case, a metal test piece is supplied to one of the weighers of a combination weighing machine and the processor ensures that at the correct time, this particular weigher is involved in the combination which is released. Nevertheless, it is still necessary to recover the test piece and to stop the weighing machine following the test cycle.

In accordance with one aspect of the present invention, an article handling system comprises a flow path along which articles travel in use; and a metal detection system having a metal detector for detecting the passage of metal items along the flow path and is characterized by a metal detector test system supporting a metal test piece, located relative to the flow path so as to move the test piece along the flow path past the metal detector in order to detect the sensitivity of the detector.

In accordance with a second aspect of the present invention, a method of monitoring the performance of a metal detection system having a metal detector for detecting the passage of metal items along a flow path of an article handling system comprises controllably moving a metal test piece along the flow path; and determining whether or not the metal detection system detects the metal test piece.

In contrast to the known arrangements, we have devised a metal detector test system which supports the metal test piece and positively moves it along the flow path. This avoids the problem of recovery since the metal test piece remains supported by the test system while in addition the test piece is moved in a predetermined manner so that accurate knowledge of its location relative to the metal detection system is obtained.

An important aspect of this invention is that although the method could be implemented while the article handling system is not operational, in the preferred approach, the metal test piece is moved along the flow path during normal operation of the article handling system. The advantage of this is that typically the articles themselves have some metallic qualities and therefore it is important that the metal detection system is insensitive to the normal articles but is still sensitive to the passage of rogue metal items. If the test was carried out in the absence of articles then the metal detection system could be set at too sensitive a level. Of course, where the articles comprise (unwrapped) food stuffs, it may be necessary to dispose of those articles which have passed along the flow path at the same time as the metal test piece but the advantage achieved by on-line monitoring will typically exceed this disadvantage.

The metal detector test system could be implemented in a number of different ways. For example, the test system may comprise a fluid operated cylinder coupled to a probe supporting the test piece; and a control system for controlling the supply of fluid to the cylinder to force the probe to move the test piece along the flow path. The cylinder could be pneumatically or hydraulically actuated.

In a second example, the system comprises a linkage assembly comprising a number of links, pivoted together

in a concertina arrangement, the test piece being supported on one of the links; and a control system for extending the linkage assembly so as to move the test piece along the flow path.

In a third example, particularly where the flow path extends in a substantially vertical direction, the test system may comprise an elongate flexible line carrying the test piece and which can be lowered along the flow path; and a control system for controlling the payout of the line.

In some cases, the metal test piece could remain in the flow path when not in use even though it may contact the articles being handled. However, in many cases this is undesirable and therefore preferably the metal detection test system is operable to move the test piece to a retracted position where it does not interfere with articles flowing along the flow path. In the case of a vertical flow path, this can be achieved by retracting the metal test piece to a position upstream of the point at which articles enter the flow path.

Typically, the parts of the metal detection test system which can be brought into the vicinity of the metal detection system are non-magnetic. This minimises the risk that items other than the metal test piece are used to adjust the sensitivity of the metal detection system.

In general, the article handling system will have a single metal detector test system. However, in some cases, more than one such system of either the same or different construction could be provided. This enables the metal detector to be tested under different conditions without having to replace the test piece. For example test pieces of different materials (iron, stainless steel etc) or different sizes could be provided on the different test systems.

The invention is applicable to a wide variety of article handling systems but is particularly suitable for

use with weighing machines and most particularly in combinational weighing apparatus.

Some examples of combinational weighing apparatus according to the invention will now be described with reference to the accompanying drawings, in which:-

Figure 1 is a schematic side view, partly cut away, of a first example;

Figures 2A and 2B illustrate the metal detector test system of Figure 1 in more detail and in two different positions;

Figure 3 illustrates schematically a second example according to the invention;

Figure 4 is a schematic, block diagram of the control system; and,

Figure 5 is a flow diagram illustrating operation of the system shown in Figures 1 to 3.

A combination weighing and counting apparatus utilizing vibrating feeders is shown in a schematic side sectional representation in Figure. 1. The illustrated combination weighing and counting apparatus is supported on a machine base frame BF, and articles transported by means of a supply conveyor 22 are supplied onto a center portion of a dispensing feeder 25 of a vibrating type through a supply chute 24. A number N of vibrating feeders 1 (1-1 to 1-n) are radially disposed around and in the vicinity of an outer periphery of the dispensing feeder 25 and are so mounted on a frame F, which is in turn supported by the machine base frame BF, as to receive articles dispensed radially outwardly from the dispensing feeder 25 while the latter is vibrated. The vibrating feeders 1 when vibrated at a predetermined amplitude and a predetermined frequency cause the articles, received thereby, to move radially outwardly and then fall downwardly onto corresponding pool hoppers 26 (26-1 to 26-n) that are arranged in a circular row on the frame F at respective locations immediately below radially outer ends of the vibrating feeders 1.

The articles transported by means of the vibrating feeders 1 are, after having been temporarily pooled in the pool hoppers 26 (26-1 to 26-n) and after discharge gates 27 (27-1 to 27-n) of some of the pool hoppers 26 (26-1 to 26-n) that have been selected according to a weighing operation has been subsequently opened, supplied onto weighing hoppers 28 (28-1 to 28-n) that are also mounted on the frame F at respective locations immediately below and in alignment with the pool hoppers 26 (26-1 to 26-n). The weight of the articles within each of the weighing hoppers 28 is measured by a corresponding weight detecting means 30 (30-1 to 30-n) such as a load cell from which a weight detection signal can be outputted. Based on this weight detection signal, a combination calculation is performed by a combination selecting means 20 built in a control device 31, and some of the weighing hoppers 28 which result in the total weight of the articles in those weighing hoppers 28 that falls within a tolerance range determined based on a target weight are selected, followed by opening of respective discharge gate 29 (29-1 to 29-n) of the selected weighing hoppers 28 with the articles consequently collected onto associated collecting chutes 32. The articles so collected in the collecting chutes 32 are then discharged through a central chute 33 to a bagging or packaging machine 34 where they are packaged in a bag containing the articles of a total weight equal to or substantially equal to the target weight.

The weighing hoppers 28 that have been emptied as a result of the previously described weighing operation perform the subsequent cycle of weighing operation after the articles have been supplied from the pool hoppers 26 during the subsequent weighing, and the vibrating feeders 1 that have supplied the articles onto the emptied pool hoppers 26 are simultaneously driven. After a predetermined quantity of articles have been supplied onto the pool hoppers 26, the associated vibrating

feeders 1 terminate their delivery operation and are held at a stand-by state. The foregoing operation of the combination weighing apparatus is executed under the control of the control device 31.

Located about a narrow portion of the chute 33 is a metal detector 35 in the form of a coil coupled with detection electronics 45. The detection electronics 45 are connected to the control device 31.

In order to test the sensitivity of the metal detector 35 a small metal sphere 36 is controllably moved into the chute 33 in the vicinity of the metal detector as can be seen in Figure 2A from a retracted position shown in Figure 2B. This is achieved by connecting the metal sphere to a non-magnetic (typically acetal) probe 37 connected to a piston 38 (Figure 4) of a double acting piston/cylinder arrangement 39. As can be seen in Figure 4, the cylinder of the arrangement 39 is connected via tubes 40,41 at respective ends to a valve 42 which in turn is connected to a compressed air source 43. By suitably controlling the valve 42, compressed air can be supplied either through the tube 40 (to extend the probe 37) or through the tube 41 (to retract the probe 37). The position of the valve 42 is controlled via a solenoid 44 connected to the control device 31. Other arrangements are envisaged, for example the arrangement 39 could have a spring to bias the piston towards one end and a single compressed air supply to act against the bias.

Figure 3 illustrates a modified embodiment in which the probe 37 is replaced by a "magic hand" or concertina arrangement of pivoted links 50 shown in solid lines in Figure 3 in their retracted position and in chain dotted lines 50' in their extended position with the test piece 36 below the detector 35. The position of the magic hand 50 is controlled by a piston cylinder arrangement 51 of an exactly similar form to the arrangement 39 and so this will not be described in more detail. The metal test

piece 36 is held on an arm 60 connected to the magic hand.

The operation of the example shown in Figures 1 and 3 is broadly similar and a typical method of operation will now be described with reference to Figure 5.

Initially various parameters must be set up (step 100, Figure 5). These include the time during which the test piece is to be located in its extended position, the time to bring the test piece to the test position, and the frequency at which the test is to be carried out. Typically, this frequency will be based on either a specified time interval or, the case of a packaging machine, upon completion of a certain number of bags (or both). For example, the test might be run every 1000 bags in a typical potato chip weighing/packaging system. The system will then start and the following steps will be carried out by the control device 31. Initially, the device 31 determines whether or not weighed articles are being discharged (step 105). If they are, a cycle counter is decremented 110 and a comparison is made to see whether the number of cycles since the last test is equal to the preset parameter (step 115). If it does, then a control device 31 actuates the solenoid 44 to connect the compressed air source 43 with the tube 40 so as to cause the probe 37 to move to its extended position shown in Figure 2A (step 120). The probe is maintained in this position for the predetermined time and then retracted.

The control device 31 monitors the output from the electronics 45 to determine whether or not the presence of metal is detected (step 125). If it is, the control device 31 stops operation of the article handling system (step 130). The reason for this is that it is possible that at the same time the test piece was brought to the extended position, another, rogue metal item was fed through the chute 33. For safety, therefore, it is important that the machine is stopped in any event. Once

the operator has confirmed that the machine is clear, he will restart it and processing returns to step 105. However, in other applications this may not be necessary.

If no metal is detected in step 105, then an error condition has arisen. Again, the machine will be stopped (step 135) allowing any rogue metal items to be removed while at the same time the control device 31 resets the sensitivity of the metal detector electronics 45 to a more sensitive setting (step 140) and processing returns to step 102.

If a test cycle has not been reached in step 115, then the system will operate in a conventional manner to monitor the electronics 45 to sense for the presence of metal items and, if detected, to stop the machine in the same way as steps 125,130.

It will be noted that in this case, whenever the metal piece is detected, the machine stops. In a modification (not shown) the machine could be provided with a divider which guides articles during a test away from the packaging machine.

CLAIMS

1. An article handling system comprising a flow path along which articles travel in use; and a metal detection system having a metal detector for detecting the passage of metal items along the flow path characterized by a metal detector test system supporting a metal test piece, located relative to the flow path so as to move the test piece along the flow path past the metal detector in order to detect the sensitivity of the detector.

2. A system according to claim 1, wherein the metal detection test system comprises a fluid operated cylinder coupled to a probe supporting the test piece; and a control system for controlling the supply of fluid to the cylinder to force the probe to move the test piece along the flow path.

3. A system according to claim 1, wherein the metal detection test system comprises a linkage assembly comprising a number of links, pivoted together in a concertina arrangement, the test piece being supported on one of the links; and a control system for extending the linkage assembly so as to move the test piece along the flow path.

4. A system according to any of the preceding claims, wherein the flow path extends in a substantially vertical direction.

5. A system according to claim 4, when dependent on claim 1, wherein the metal detection test system comprises an elongate flexible line carrying the test piece and which can be lowered along the flow path; and a control system for controlling the payout of the line.

6. A system according to any of the preceding claims, wherein the metal detection test system is operable to move the test piece to a retracted position where it does not interfere with articles flowing along the flow path.

7. A system according to claim 6, wherein the retracted position is located upstream of a point of entry of articles into the flow path.

8. A system according to any of the preceding claims, wherein the parts of the metal detector test system which can be brought into the vicinity of the metal detection system are non-magnetic.

9. A system according to any of the preceding claims, wherein the metal detection system comprises a metal detector in the form of a coil surrounding the flow path.

10. A system according to any of the preceding claims, further comprising a processing system for monitoring the result of moving the test piece past the metal detector and for adjusting the sensitivity of the metal detection system, if necessary.

11. A system according to any of the preceding claims, wherein the system comprise a combinational weighing apparatus including a number of article weighers, and a controller for causing articles in a selected combination of the weighers to be passed to the flow path, when the combination satisfies a predetermined condition.

12. A method of monitoring the performance of a metal detection system for detecting the passage of metal items along a flow path of an article handling system, the method comprising controllably moving a metal test piece along the flow path; and determining whether or not the metal detection system detects the metal test piece.

13. A method according to claim 12, further comprising stopping the article handling system if the metal detection system does not detect the test piece.

14. A method according to claim 12 or claim 13, further comprising stopping the article handling system if the detection system does detect the test piece.

15. A method according to any of claims 12 to 14, wherein the metal test piece is moved along the flow path during normal operation of the article handling system.

16. A method according to any of the claims 12 to 15, wherein the article handling system is constructed in accordance with any of claims 1 to 11.

17. An article handling system such as hereinbefore described with reference to any of the examples shown in the accompanying drawings.

18. A method of monitoring the performance of metal detection system, substantially as hereinbefore described, with reference to any of the examples shown in the accompanying drawings.

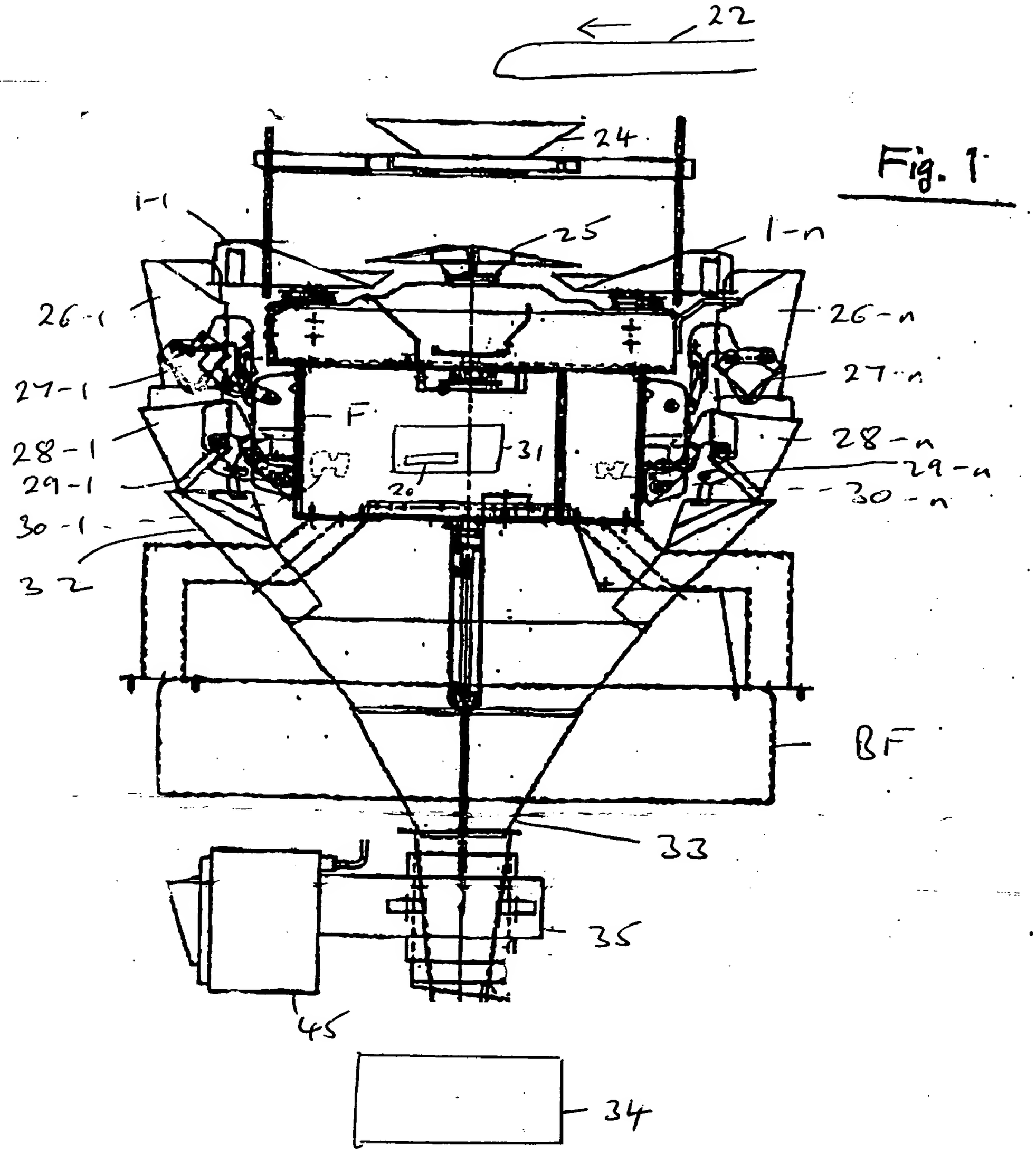
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Fig. 1

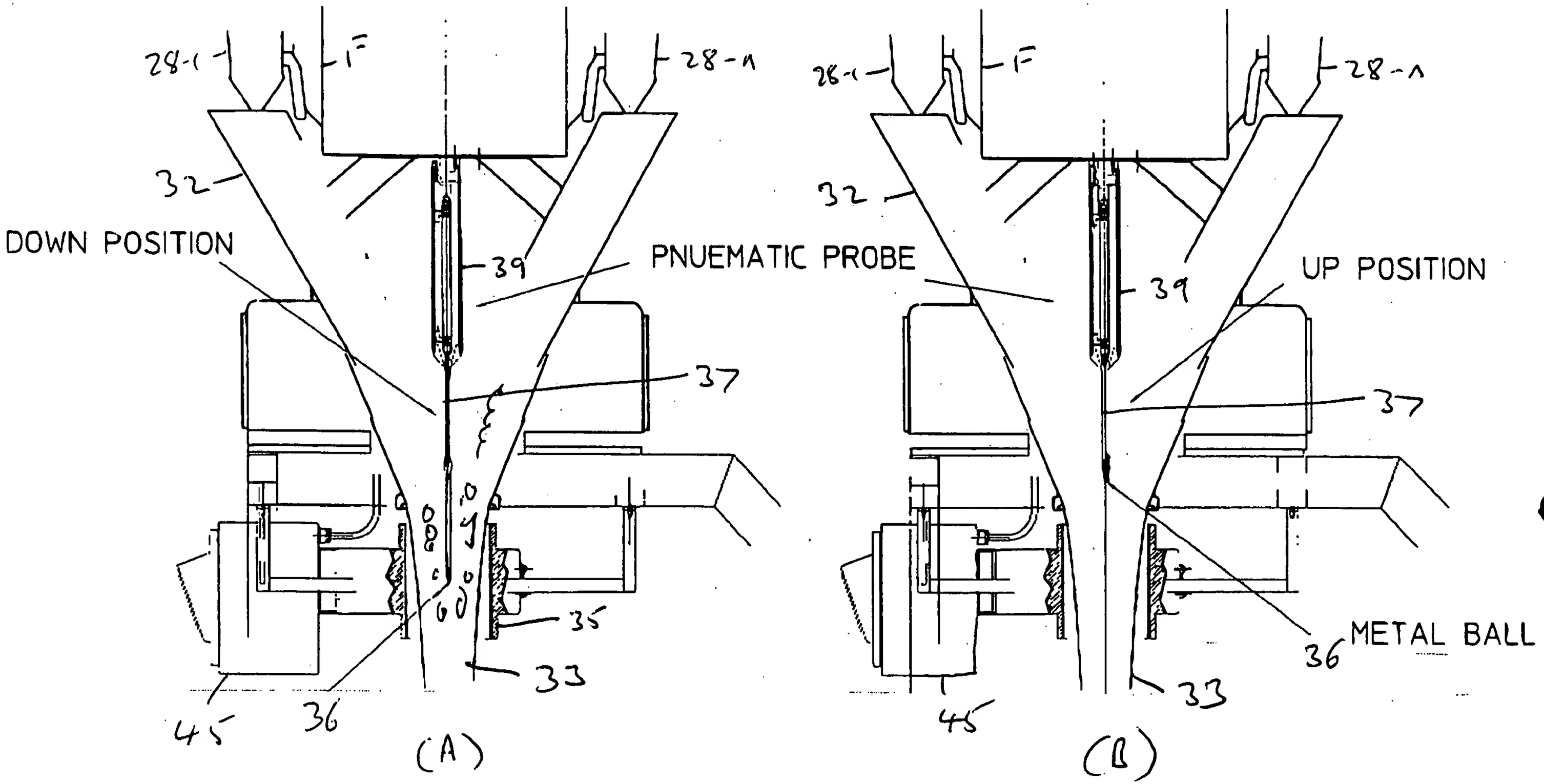
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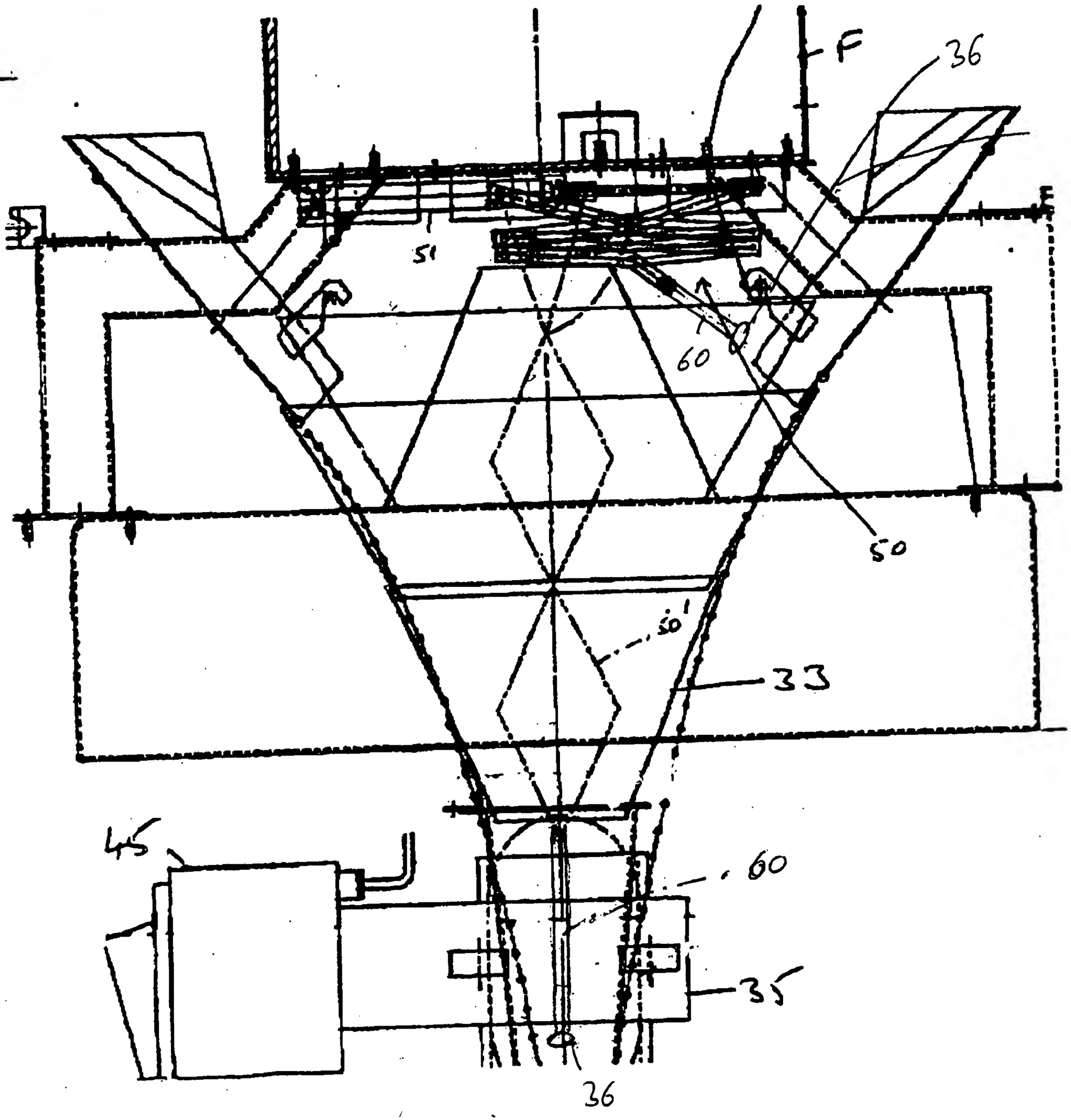
FIG 2

Fig. 3



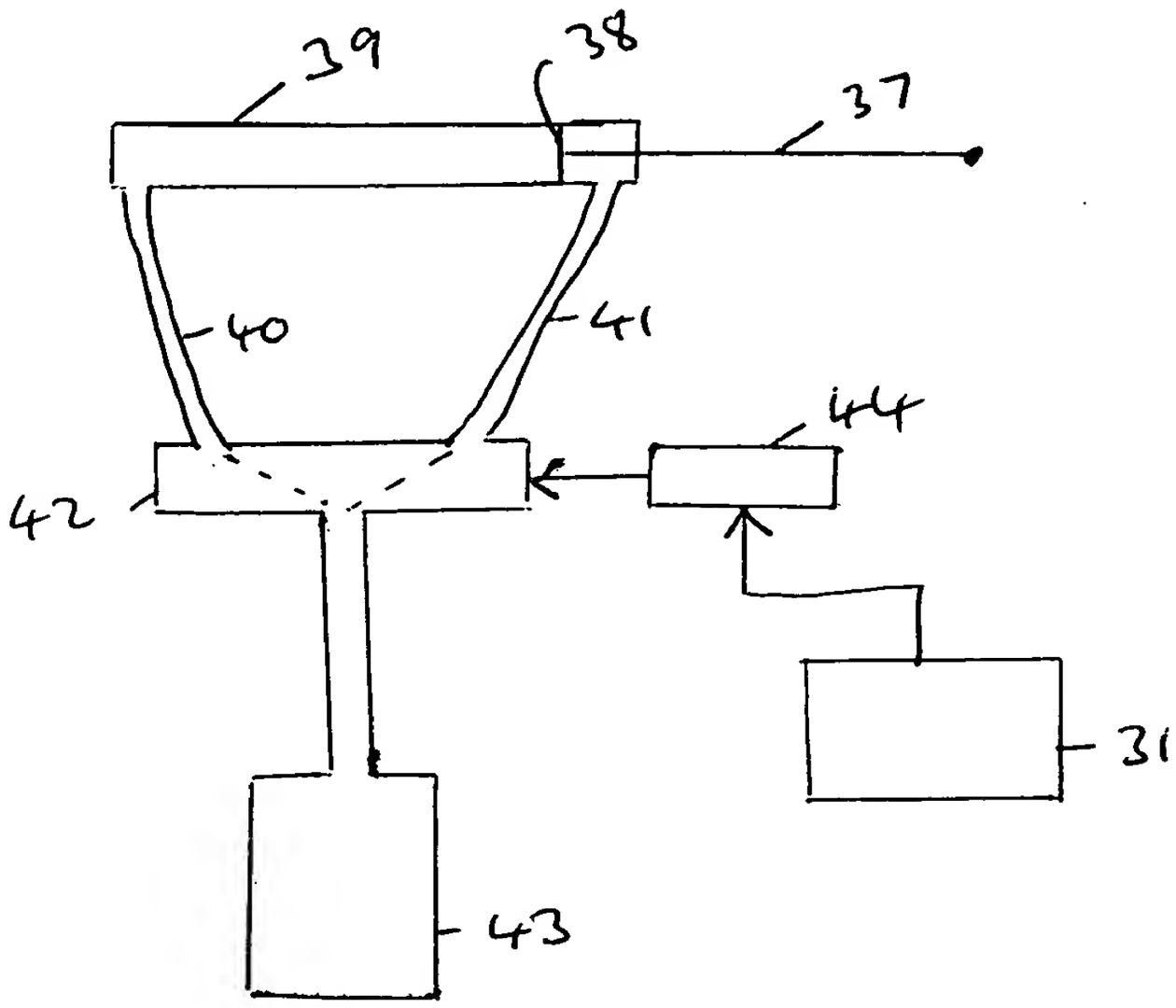
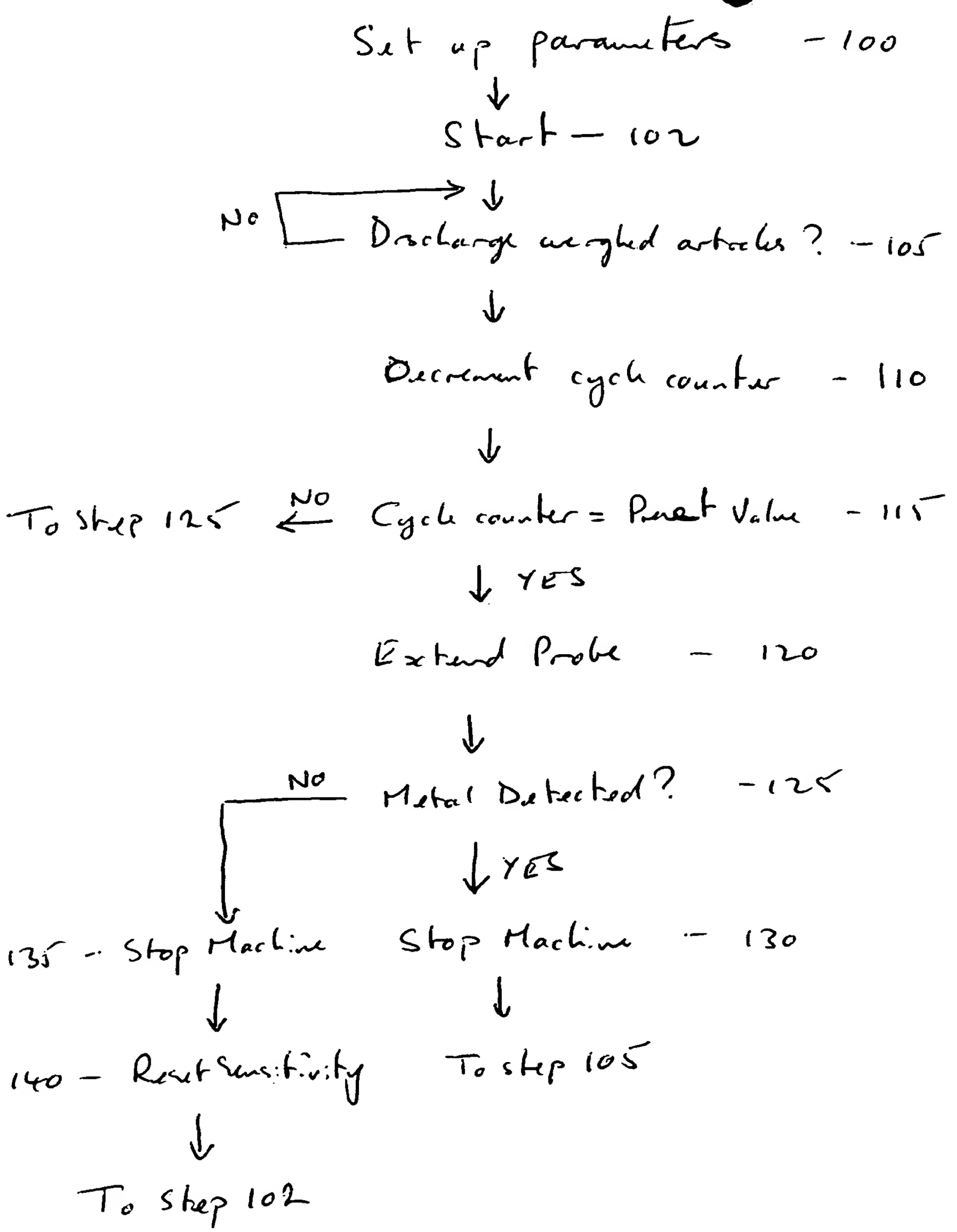


FIG 4


Set up parameters - 100
Start - 102
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Decrement cycle counter - 110
To Step 125
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Extend Probe - 120
NO
Metal Detected? - 125
YES
135 - Stop Machine
Stop Machine - 130
140 - Reset Sensitivity
To step 105
To step 102

FIG 5